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EXAMINER	
CHANG, AUDREY Y	
ART UNIT	**PAPER NUMBER**
2872	

DATE MAILED: 02/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

Office Action Summary	Application No.	Applicant(s)	
	09/530,968	GROSSETIE ET AL.	
	Examiner	Art Unit	
	Audrey Y. Chang	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 30 November 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-25 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-25 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on November 30, 2004, which has been entered into the file.
- By this amendment, the applicant has amended claims 5, 8-9 and 17-20.
- Claims 1-25 remain pending in this application.
- The rejections to claims 8, 10-13, 20 and 22-25 under 35 USC 112, first paragraph, set forth in the previous Office Action **still hold.**
- The rejections to claims 1-25 under 35 USC 112, second paragraph, set forth in the previous Office Action **still hold for the reasons stated below**.
- The objections to claims 22-25 with respect to improper multiple dependence are **withdrawn** in response to applicant's amendment.

Claim Objections

1. **Claims 5-8, 10-13, 17-20, 22-25 are objected to because of the following informalities:**

(1). **Claims 5 and 7 have been amended** to include the phrase "a complex two-dimensional image by determining a complex *number* for each pixel of the two dimensional image defined by the corresponding real function" that is confusing and indefinite since it is not clear what is considered to be the "*each pixel* of the two dimensional image". Also how could one obtain a complex number by a real function? A complex number by definition is (real number +I* imaginary part). This means the complex number can only be the real function. It is therefore not a real complex number.

(2). The phrase "a spatial light modulator for physically reproducing the hologram of the object" recited in claim 22 is wrong. The spatial light modulator cannot "reproduce" the hologram but can

display the hologram information. Reproduction of a hologram is known in the art as light **diffracted** by the hologram (interference fringes) to "reproduce" the recorded image in the hologram.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. **Claims 5-8, 10-13, 17-20, 22-25 are rejected under 35 U.S.C. 112, first paragraph**, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The reasons for rejection are set forth in the previous Office Action dated August 30, 2004.

Claims 5 and 17 have been amended to include the phrase "**converting** the two dimensional image defined by the corresponding real function into a complex two dimensional image by determining a complex *number* for each pixel of the two dimensional image defined by the corresponding real function". The specification and the claims fail to teach how could a real *function* being *converted* to a complex *number*. The specification and the claims fail to provide the essential criterion for such "conversion". Applicant argues in the Remark that the conversion is intended for the "application of a **diffuser** to the image", (Remark page 9, paragraph 5), if such is the case, then it should be explicitly stated to make the "conversion" enabled.

Claims 5 and 17 have been amended to include the phrase "simulating *diffraction* of an optical wave by an image correspond to the onversampled complex image". The specification and the claims fail to teach how could one "simulating diffraction of the optical wave" by the complex images. If the

complex image is the **result** of the diffraction of the optical wave then the simulation step here should be the simulation of the "**optical wave**", namely obtaining the *optical wave* instead of "diffracted image", since the complex image is already being considered as the **diffracted image**.

Claims 8 and 20 have been amended to include the phrase "computing convolution of functions ... by applying the **complex** transform". It is not clear how could the convolution of functions being computed by "the complex transform".

A ***convolution*** is defined as: $f(x) = \int g(u)h(x-u)du$, with the integral between (negative infinity to positive infinity). It is a measure between the correlation between to functions g(u) and h(u). It is not clear what are the "complex transform" and "inverse of said complex transform to the product of respective complex transforms of said two functions" with respect to the "convolution" here.

The specification also fails to teach how can the amplitude be determined as "determining amplitudes associated with each pixel of said image by computing for each pixel of said image, the square root of a **corresponding value** of said real function", **recited in amended claim 18**. It is not clear what is this "amplitudes" and what is the "**corresponding value**", also what is the "*pixel* of the image". If the amplitude value is referred to the computed hologram then it should be referred as the "square root of the amplitude **transmittance** of the sum (or interference) of the diffracted (or optical wave) wave and the reference wave".

Claims 6, 7, 10-13, 18, 19 and 22-25 inherent the rejections from their respective based claims.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. **Claims 1-25 are rejected under 35 U.S.C. 112, second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

The claims contain a lot of vague terms and mathematical computations that are not well defined with physical meanings and not related to each other in a definite sense. The scopes of the claims therefore are very confusing and indefinite. The applicant is respectfully reminded that until the physical meanings of each mathematical computation is clearly defined and claimed, these computations are considered to be nominal and arbitrary mathematical process that have no meanings and the scopes of the claims are therefore not clearly defined.

Claims 5 and 7 have been amended to include the phrase "simulating *diffraction* of an optical wave by an *image* corresponding to the oversampled complex image" that is confusing and indefinite since it is not clear **what** is being simulated here? If the "**diffraction** of an optical wave" is being **simulated** here **by** the complex image, then this mean the *complex image* is the **result** of the **diffraction** of the optical wave. It is therefore not clear what is being *simulated* here and how are the "*resulting* diffracted image" being obtained.

The phrase "encoding amplitude value" recited in claim 5 is confusing and indefinite since it is not clear what is considered to be the amplitude value.

The phrase "computing convolution of functions ... by applying the complex transform which is the inverse of said complex transform to the product of the respective complex transforms of said two functions" recited **in amended claims 8 and 20** is completely confusing and indefinite which therefore

makes the scopes of the claims completely unclear. The description of claims 8 and 20 is confusing and in error.

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claim 23 recites the broad recitation "less than 10 μm", and the claim also recites "preferably from 1 μm to 2 μm" which is the narrower statement of the range/limitation.

The ***applicant*** is respectfully reminded to clarify **ALL** of the ***discrepancies*** in the claims to make the claims in comply with the requirements of 35 USC 112, first and second paragraphs. The examiner can only point out a few; it is applicant's responsibility to correct all of the discrepancies.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-4 and 14-16 are rejected under 35 U.S.C. 102(b) as being anticipated by the patent issued to Haines (PN. 4,969,700).

Haines teaches a system and method for generating holograms from a *computer model* of any *object* (30, Figures 1-4) wherein the method comprises the step of *computing* a *set* of *two-dimensional images* (200 and 400) representing the *object* (30) from perspective *different viewpoints* (52 and 54) in a three-dimensional space, the step of *computing element holograms* (52 and 54) for the corresponding two-dimensional images wherein the element holograms are *combined* to form the hologram (50) of the object, (please see Figures 1-4 and columns 3-6). Haines teaches to use computer model for representing any object that are three dimensional in extend. This means the object is a *virtual* three-dimensional object. Haines also teaches **explicitly** that that associated with each elementary hologram (52 and 54), is a *view* of *the object* and the view consists of light rays from **all parts of the object, that is to say a full view of the entire object is represented at each element hologram (52 and 54), (please see column 5, lines 1-6).**

The different perspective *viewpoints* (52 and 54) constitute a *matrix* of *points* in a first geometric plane (50) that is separate from the object. The set of two-dimensional images on a second plane is formed by the **projection** of the object as seen from the respective viewpoints (52 and 54) on the first geometrical plane.

Haines teaches that the element hologram for each of two-dimensional image is calculated using technique including Fourier transformation.

With regard to the feature concerning "set of two dimensional images representing the object as seen from perspective different viewpoints in the three-dimensional geometrical space". Haines teaches specifically that image light rays along the paths (22 and 24, Figure 1) which creating the image points (such as 220 etc.) on the two dimensional images (200 and 400) will be **seen** by **the viewers** at 52 and 54,

(please see column 4, lines 35-37). The viewpoints (52 and 54) therefore are the physical viewer positions and the image representations (200 and 400) are **real images** of the object seen by different viewer at 52 and 54. The image light rays (22 and 24) are generated by light beams from a light source (10) and diffused off the object as shown in Figures 1 and 4.

With regard to the features of having a first and second geometrical planes. Haines teaches that the holographic surface (50) serves as the first geometrical plane that is separated from the object (30) and having a matrix of observer positions or viewpoints (52 and 54). The light rays diffused from the object along the different observer viewpoints will form the projected images of the object on the plane that is mapped by the images (200 and 400). The window 200 and 400 serve as the second geometrical plane.

This reference has therefore anticipated the claims.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. **Claims 5-13 and 17-25 are rejected under 35 U.S.C. 103(a)** as being unpatentable over the patent issued to **Haines** in view of the patent issued to **Saito** et al (PN. 5,668,648) and "Fourier transform computer-generated hologram: a variation on the off-axis principle" by **Michelin et al** (SPIE vol. 2176 1994/249).

The method and system for making computer generated hologram from a computer model of any object taught by *Haines* as described for claims 1 and 14 above has met all the limitations of the claims. Haines teaches that the elementary holograms correspond to the set of the two-dimensional images are

obtained by calculating the *amplitude* and *phase* of the interference between the sample rays and reference ray using ***Fourier*** transformation. The amplitude obtained generally is *complex amplitude*, (please see column 5, lines 50-55). It is known in the art that the phase and amplitude information of the image light suggests that the optical waves for the images are of complex functions.

This reference has met all the limitations of the claims with the exception that it does not *explicitly* teach the calculation steps recited in the claims for calculating the element holograms. **Saito et al** in the same field of endeavor teaches a computer-assisted holographic display apparatus that is comprised of a *diffraction image computation section* (12) for receiving an input image data signal that represents a three dimensional object (20) and to compute the corresponding *diffraction pattern data* with a first sampling density. The apparatus further comprises *second computation section* that is connected to the diffraction image computation section to subject the diffraction pattern data to the *interpolation process* (28) so as to created *interpolated diffraction pattern data* with a *second sampling density* that is *increased* (i.e. an oversampling process). A *third computation section* (30) is connected to the second section to compute the *interference pattern data* between the *interpolated* diffraction data pattern and a reference wave. The interference pattern data is obtained by using the multipliers (174, 176, Figure 8) and adder (178, Figure 8), which corresponds to the addition (or superposition) of the diffraction wave and reference wave. Saito et al teaches that Fourier transformation could be used in the computation process. Saito further teaches that the computer-generated holograms are displayed on a *spatial light modulator* (16, Figure 1) wherein light source may be used to physically reproduce the hologram image of the object. With regard to claims 12-13 and 24, light sources of different color can be used to reproduce holograms of different colors, (please see Figure 12). **Michelin et al** in the same field of endeavor also teaches the standard computation process for making Fourier-transform computer-generated hologram that includes using **Fourier transformation** to make the original planar image f, (i.e. a real function) to become a complex function. A complex field representing the reference wave then is

added to the complex image function to compute the amplitude transmittance, (please see page 250). It would then have been obvious to one skilled in the art to apply the teachings of **Saito and Michelin** et al to modify the computer generated hologram of Haines to efficiently compute the element hologram information and to display the element holograms on a spatial light modulator such as liquid crystal display.

With regard to the feature (as recited in claim 6), concerning "said amplitude value each depending on the square root of a corresponding intensity value taken by the real function of the given two-dimensional image". Such feature is implicitly included in the wave theory of the image light, wherein intensity of the image light wave is the absolute square of the amplitude value of the wave function.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. **Claims 1-25 are rejected under the judicially created doctrine of obviousness-type double patenting** as being unpatentable over claims 1-32 of **U.S. Patent No. 6,344,909** in view of the patent issued to Haines (PN. 4,969,700).

The instant application and the cited patent teach exactly the same calculation process for producing hologram from two dimensional object images with the exception that the cited patent does not

claim the procedure of obtaining the two-dimensional image data from a three dimensional object. However the steps for obtaining the set of two-dimensional images representing different viewpoints in three-dimensional space of an object is commonly known in the art as described in the prior art patent issued to Haines. Such difference therefore does not give a patentable distinction between the instant application and the cited patent (PN. 6,344,909).

Response to Arguments

11. Applicant's arguments filed on November 30, 2004 have been fully considered but they are not persuasive. The newly amended claims have been fully considered and they are rejected for the reasons stated above.

12. In response to applicant's arguments, which state that the cited Haines reference "does not teach a method or system of producing a hologram of a virtual object which involves the step of computing a set of two-dimensional images representing "the object" (i.e. entire object) as seen from respective different viewpoints in thee dimensional geometric spaces and computing elementary hologram based thereon", the examiner respectfully disagrees for the reasons stated below. **Firstly, Haines** states **explicitly** that associated with each grid (52 or 54), which is the respective **viewpoint** and correspondingly calculated elementary hologram, is **a view of the object** and the view consists of light rays from **ALL PARTS** of the **object, (i.e. entire object),** which construction pass through the grid element or the elementary hologram, **(please see column 5, lines 1-5)**. Haines therefore **does** teach to use "*a set of two dimensional images representing the object as seen* ***from respective different viewpoint*** *in the three dimensional geometric space, each of said two dimensional images* ***representing*** *the* ***object*** *as seen from one of said different viewpoint" (please see claims 1 and 14),* as the base for calculating the hologram and it is of the **same** way as the instant application claims, (emphasis added). Applicant is respectfully noted that the instant application ALSO claims to use a set of two-dimensional images, representing the object *as seen*

from different viewpoints, as the base for calculating the holograms. It is implicitly true that a *two dimensional image* of a *three dimensional object* as *seen from a viewpoint* can never be able to represent "the entire object" since one cannot see the backside of the object. If Haines only have restricted view, the instant application will also just have restricted view to the object, in the same manner. **Furthermore**, the applicant is respectfully noted that the features upon which applicant relies (i.e., entire object) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

13. In response to applicant's arguments which states that the cited Haines reference does not teach the "claimed two dimensional image" however the claims only claimed "two dimensional image representing the object as seen from a respective view point" which is exactly how Haines defines the two dimensional image of the object as viewed at viewpoint.

Conclusion

14. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 571-272-2312. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Audrey Y. Chang
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A. Chang, Ph.D.